

Mastering the Thesis

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About this document

The goal of this document is to clarify what should go where in a master thesis. The intended reader is students writing an experimentally oriented master thesis at the I:RIS program at the department of informatics.

*The intention is to provide **a limited set of generic questions for each section**, that may help students find a structure that works with their content.*

The intention is *not* providing a method for doing the hard work required to finish a master thesis, but rather giving some pointers on how to sort “*what-should-go-where*” when writing. In turn, this may aid in the process of determining whether there are parts missing, although the intention is not to provide an elaborate list.

This document is built on the “IMRaD” structure commonly used in research. That structure is taken for granted, and the goal here is not to duplicate information on research papers that can be numerous places, but rather put relevant questions into the context of a master thesis.

About length, structure and learning by experience

The length of each section in a thesis will vary greatly depending on the topic and field of research. Some tasks will require more theoretical background, while others may have longer method descriptions, results or analysis.

It is expected that simulation-based experiments gain more results and have more refined analysis compared to complex experiments performed physically. When there is a choice, it is expected that the experiment that leads to results with the least amount of effort is chosen, unless there are specific reasons to do something else. Be sure to state your specific reasons.

When one experiment relies heavily on the outcome of others, it may be beneficial to create subsections with method-result-analysis for each experiment. There is no exact answer to when such a structure is beneficial, but when doing so, create an initial method chapter that describes the rationale for using this structure and do analysis that is common to all experiments after the final result subsection.

It is not always possible to know what the best way would be to conduct an experiment before performing the experiment. This is part of the experience of doing a master thesis, be humble about your experience and share your findings of such matters in the discussion.

Good luck writing your thesis!

-Yngve

Introduction

Motivation

- What is the topic chosen for the thesis?
- Why is this topic important?
- What are the research questions for this thesis?
- Why are these questions relevant?
- What are relevant ethical questions or considerations to your research?

Related work

- What are the nearest related scientific work to your research?
 - What has been done, found or achieved? (*Their contribution to the field*)
 - Who are the authors and when and where was their research conducted?
 - How did you find that research?
 - Are there survey articles covering the topic?
 - Is it few or barely any relevant sources?
 - How did you perform your search?

Theoretical framework

- What is the theoretical foundation for this thesis?
 - What are the theories, ideas, principles and assumptions required to understand your considerations?
 - *Describe to enable someone with a bachelor's degree in your field to read and comprehend the thesis.*

Method

- What is your planned scientific contribution (experiments)?
 - What do you expect or plan to discover in each experiment?
 - How do/did you plan to perform them?
- What is the rationale behind your choices for the experiment?
 - How does these relate to your research questions?
 - How does this relate to the theories and related work presented in the introduction?
- What conditions or assumptions are prerequisite for the results to be valid?
 - What would invalidate your results? (*if that is possible*)
 - *To distinguish between the sections, let this part about “foreseeable”, while the analysis treats actual results.*
- Did or might your results lead you to perform new experiments?
 - Why would the results dictate new experiments? (*Planned or not*)
 - How do new experiments relate to your research questions?
 - How do they relate to the presented theories and related work?
- How were the experiments performed?
 - How can others replicate your work?

Note on code:

Sometimes experiments require specific algorithms and code. Normally these are best described as pseudo code or schematics- unless there are reasons tied to the research questions that dictate specific programming language use. Specific code is normally best placed in an appendix. Readers should be able to understand and replicate your work without the appendix, but it could speed up the process. Algorithms can also be a result in some cases.

Results

- What is the data gained from your experiments?
 - *Present your data in a way that allows the reader to understand their significance with respect to the research questions.*
 - Are there (good) ways to visualize the content using figures?
 - Can the results be presented with their respective statistical significance? (Standard deviation, variance, etc)

Note on raw data:

Long lists of raw data is normally best put in an appendix or in a repository. The result section should normally present the results that are significant to your analysis and discussion. Avoid presenting long lists of data that do not have significance to the research questions.

Discussion

Analysis

- What do your results indicate?
 - To what degree are your data statistically significant?
 - Are there particular outliers in your data?
 - What are possibly sources for these outliers?
 - To what degree does the result match your expectation?
- Did your initial results cause you to conduct new experiments?
 - *Explain based on the results presented.*

Conclusion

- What is the significance of your results with respect to the research questions?
 - Did you manage to answer your research questions?
 - *To what extent does your result answer your research questions?*
- What is the significance or impact of your results?
 - How does your data compare with other work in the field?
 - Is further research required to answer your research questions?
 - Are there new questions that seem relevant to research based on the results you have got?
 - Are there any ethical implications in relation to your findings?
- *If you were to start over, what would you have changed in your research or methods?*

Appendix

An appendix should normally list code, raw data and in some cases schematics that may help someone trying to reconstruct or revise your experiments. Tables with data that are more than a couple of pages is normally better put in a repository (github or similar) for public access (for a limited amount of time). The method description should normally be good enough that experiments may be replicated without the use of the appendix, however an appendix could help speed up the process.

Abstract

The abstract should summarize all your work, and it is usually the last part you should write, even though it is usually positioned first in or before the introductory section. The abstract shall contain the highlights of your work to let the reader know if or why they should read your work.

- What are the research objectives?
- Which methods were used?
- What were your main findings or scientific contributions?
- What are the most important conclusions in your research?

Note on contributions:

Some sensors prefer that a master thesis contain a subsection to the introduction called contributions. The intention of such a chapter is to declare the scientific contribution of the thesis.

As written in this document, the scientific contribution is covered in the conclusion and abstract. Following this structure, it will be hard to create a separate contribution subsection without providing the same information twice, which is a practice that generally should be avoided (with the notable exceptions for abstracts and conclusions).

It is not a scientific flaw to provide the same information twice, and it is a good idea to have an idea of what the contribution could be (part of the motivation for doing the thesis); however, duplicating information makes any document harder to maintain. It is thus recommended to create chapters that most likely duplicate information as late as possible in the process, if doing so at all.